DOCUMENT RESUME

ED 372 813 JC 940 456

AUTHOR Hart, Patricia Kate
TITLE An Investigation into the Feasibility of Interactive Distance Education Courses at the Community College Level.
PUB DATE Jan 94
NOTE 98p.; Master's thesis, Ferris State University.
PUB TYPE Dissertations/Theses - Masters Theses (042) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS Area Studies; College Planning; Community Attitudes; *Community Colleges; *Cost Effectiveness; *Distance Education; Educational Needs; *Feasibility Studies; *Needs Assessment; *Program Costs; Program Development; Student Attitudes; Two Year Colleges

ABSTRACT

A study was conducted at Northwestern Michigan College (NMC), in Traverse City, to evaluate the variables affecting the feasibility of distance education to meet the educational needs of the college's geographically isolated community. Data sources included a literature review and student, faculty/staff, and community opinion surveys conducted by the state department of education and local chamber of commerce from 1991 to 1993. In addition, NMC piloted several two-way interactive classes between the main campus and the Cadillac campus, conducted a survey of these students, and gathered college and state cost data on distance education. Study findings included the following: (1) a lower percentage of residents in the five-county area serviced by NMC had four-year degrees than in the state as a whole, and per capita income was $3,680 lower than the state; (2) area residents indicated a desire for NMC to becomes a university or for the college to expand opportunities for advanced degree courses; (3) among students enrolled at NMC in winter 1991, 46% listed university transfer as their primary goal; (4) the Traverse Bay Economic Development Corporation identified the lack of baccalaureate programs as an impediment to business growth; (5) sufficient funding sources were found to support distance education efforts; and (6) students enrolled in pilot distance courses indicated they would take additional courses and recommend them to others. Tables of equipment required and costs for two-way interactive audio and video, and 60 references are appended. (KP)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 372 813

An Investigation into the Feasibility of Interactive Distance Education Courses at the Community College Level

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☐ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

by

Patricia Kate Hart

PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
P. Hart
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

A thesis

Submitted to the Faculty

of The School of Education in partial fulfillment of

the requirements for the Degree of Masters of Science

in Occupational Education

Ferris State University

January, 1994

JC 940 456

BEST COPY AVAILABLE

TABLE OF CONTENTS

LIST OF TABLES iv

CHAPTER I 1

The Problem 1

Introduction and Background 1

Statement of Problem Situation 3

Purpose of the Study 5

Delineation of the Research Problem 5

Statement of the Hypothesis 6

Definition of Terms 6

Scope and Delimitations of the Study 8

CHAPTER II 10

Review of Related Literature 10

History 10

Planning 13

Cost Analysis 14

Faculty Issues 25

Evaluation 27

CHAPTER III 30

Methodology 30

CHAPTER IV 46

Research Findings 46

Summary of Major Findings 65

CHAPTER V 68

Summary and Discussion 68

APPENDIX A — Specific Equipment Required for Classrooms Sending & Receiving Two-way Interactive Audio & Video 83

APPENDIX B — Breakdown of Two-way Interactive Audio & Video Costs 85

APPENDIX C — Transmission Costs for Two-way Interactive Audio & Video 87

BIBLIOGRAPHY 88

LIST OF TABLES

1. Sampling Error for Survey of Former Students 35

2. Sampling Error for Students Enrolled at NMC 36

3. Type of Program High School Juniors and Seniors are Enrolled In 50

4. Plans after Graduation by Programs High School Students are Enrolled In 51

5. Type of Degree by Program High School Students are Planning to Get 53

6. Attendance at Northwestern Michigan College for Two Years and University Center for Two Years by Program Areas 54

7. Students Learned as Well in Distance Education as in a Traditional Course 58

8. Students Recommendation of Interactive Video Courses to Others by Course Term 59

CHAPTER I

The Problem

Introduction and Background

Higher education is faced with the dilemma of having to provide educational opportunities to an increasing and diverse population with decreasing resources. "Tidal waves of economic, demographic, educational, and technological changes demand that colleges reconsider what they will teach, how they will teach, whom they will teach..." (Levine, 1992). Educational institutions are expected to continuously provide higher quality programs and demonstrate effectiveness through measuring outcomes. The demographics of undergraduate students has changed in recent years. The average age of college students is increasing as some choose to delay entrance, some return to upgrade skills, and others return to pursue a new occupation. The average course load carried by students is decreasing as more students study part-time and are likely to have family and job responsibilities. These responsibilities make students more likely to be time-bound and space-bound (Levine, 1992).

Distance education is an effective method for providing education to an increasing and diverse population of students. It allows for flexibility in scheduling, location and teaching methodology. Distance education is not a new concept. It began in England with off-campus studies through a system of

lectures which evolved to the written correspondence course.

The mediums used for distance education have changed as technology has increased. The 1930's brought broadcast radio which progressed to broadcast television in 1950. By the early 1980's, 71% of the colleges and universities in the United States made use of television (Shiveley, 1982).

During the 1980's several other technological developments increased the availability of distance education mediums. The United States was wired for cable television and video cassette recorders became household consumer items. Full motion television technologies such as Instructional Television Fixed Service and point-to-point microwave gained popularity.

The 1990's have brought CD-ROM, compact disc interactive and digital video interactive technologies (Brey, 1991). The most important technological trend seems to be the integration of communication and computer technology. As communication technology has transcended from an analog technology to more digital transmission and storage methods, it increasingly resembles computer technology (Simpson, Pugh, & Parchman, 1991).

Distance education technology is accelerating the removal of traditional barriers to competition among post-secondary institutions for students and institutional resources. In 1991, 58% of two-year institutions had a distance education program via telecommunications, 20% were planning a distance

education program, while 22% did not have a distance education program. It is expected that by 1994, 80% of all two year institutions will have distance education programs, while only 67% of four year institutions will have distance education programs (Brey, 1991). These trends cannot be ignored by post-secondary institutions.

Statement of Problem Situation

Northwestern Michigan College is geographically isolated from four-year institutions of higher education. This has presented challenges for residents who want to continue their education past the second year of college. According to a Michigan Department of Education Project Outreach Survey (Michigan Department of Education, 1991 a) of area residents, 81% of the respondents said it was important or somewhat important that four-year college classes be expanded, 88% indicated that a college education was very important, 65% stated that they would take more college courses if a greater variety of courses was offered, and 57% of the residents responding wanted college offerings closer to home.

Northwestern Michigan College serves the five county region of Antrim, Benzie, Grand Traverse, Kalkaska, and Leelanau counties. According to the 1990 U.S. Census (1990), the percentage of high school graduates for this region was 78.5%, or 1.7% greater than the Michigan total of 76.8%. The percentage of bachelor degrees or higher for the five counties

was 16.4%, which was 1.0% lower than the State's total of 17.4%. In addition to a lower level of degree completion, the per capita income in 1990 for the five counties was $3,680 lower than the State.

While the need exists for expanded higher education opportunities in the region Northwestern Michigan College serves, the College does not intend to abandon its mission as a Community College to become a four-year institution. In 1992, discussions began on how to best meet the educational needs of the community. The concept that evolved is referred to as a University Center. This is a relatively new concept that involves partnerships with four-year institutions to offer courses beyond the second year of college.

The focus of campus-wide discussion has turned to the best way to facilitate the delivery of courses. Northwestern Michigan College began to use two-way interactive video and audio instruction to a remote site located 50 miles away in Cadillac, Michigan, in the Fall of 1992 as a pilot project. It is now necessary to determine whether two-way interactive video and audio is an effective method both as measured by cost and educational outcomes for the offering of courses. If so, this technology would be used to deliver advanced courses as coordinated by the University Center.

Purpose of the Study

The purpose of the study is to determine the long-term financial and educational feasibility of Northwestern Michigan College utilizing in distance education technology. It is expected that the results of this study will offer insight for other educational institutions formulating distance education strategies. While many questions will be addressed, the need for expanded research and analysis in distance education will also be suggested.

Delineation of the Research Problem

To determine the long-term feasibility of Northwestern Michigan College utilizing distance education technology to provide expanded educational opportunities there are several factors that need to be considered. First, the need for distance education must be established. Next, the appropriate technology must be chosen as the mode for transferring the educational process. The technology must be chosen based on an analysis of its perceived strengths and challenges.

The cost of distance education must be analyzed based on what technology is currently available at the institution, what additional capital is needed to implement distance education and the operating costs of the anticipated system. These costs will vary depending on the distance education technology used, the number of students to be served and the geographic location of those students.

Statement of the Hypothesis

This study will answer the following research questions:

1. Is there a need for expanded educational opportunities in the region Northwestern Michigan College serves?

2. What are the perceived benefits of using distance education?

3. What hardware components are currently available at Northwestern Michigan College for implementing distance education?

4. What are the implementation costs for distance education at Northwestern Michigan College?

5. What funding sources are available to provide the resources necessary to implement the distance education plan for Northwestern Michigan College?

6. What are the operating costs of distance education at Northwestern Michigan College?

7. What planning process should be used to make decisions on implementation and evaluation of distance education at Northwestern Michigan College?

Definition of Terms

The following terms are defined to clarify their use in the context of the study:

COST-BENEFIT ANALYSIS: Evaluates decision alternatives by comparing the costs and benefits to society. Both costs and benefits are measured in monetary values.

COST-EFFECTIVENESS ANALYSIS: Compares program outcomes with the costs of alternate programs when the objectives of different programs are similar and when common measures of effectiveness are used.

COST-FEASIBILITY ANALYSIS: Estimates the costs to ascertain whether or not the alternative is realistic, given an existing budget.

COST-UTILITY ANALYSIS: Yields the alternatives that, according to professional judgements, are most likely to produce the most desired outcomes at the lowest cost.

DISTANCE EDUCATION: According to Garrison and Shale (1987), Distance education is "a means of extending access to education to those who might otherwise be excluded from an educational experience." They further argue that the following are essential criteria for the distance education process:

1. The majority of educational communication between (among) teacher and student(s) occurs noncontiguously.

2. It must involve two-way communication between (among) teacher and student(s) for the purpose of facilitating and supporting the educational process.

3. It uses technology to mediate the necessary two-way communication (Garrison & Shale, 1987).

TWO-WAY INTERACTIVE VIDEO AND AUDIO: For this study two-way interactive video and audio means the

same as two-way interactive television. This study also uses two-way interactive video as a synonym to both of these terms.

Scope and Delimitations of the Study

This study was conducted to evaluate the variables affecting the feasibility of distance education at Northwestern Michigan College. While generalizations may be appropriately made to other higher education institutions, it is not the intention of the researcher to make such generalizations. It is anticipated that this study will provide a framework that other institutions may use in analyzing the feasibility of using distance education technology.

Northwestern Michigan College made a commitment to distance education in 1992 with a pilot project providing distance education courses to students at a remote campus located 50 miles away in Cadillac, Michigan. There have also been extensive discussions with four-year institutions regarding the use of two-way interactive video and audio to provide expanded educational opportunities to the residents of Northwestern Michigan College's service area. It would be very difficult to reverse the momentum of implementing expanded distance education opportunities at the time of this study. Northwestern Michigan College is committed to the use of distance education technology. This study may impact the

magnitude to which the technology use is expanded and the process used to make decisions on implementation and evaluation.

CHAPTER II

Review of Related Literature

History

American higher education was developed with a strong European influence. Educators studied German and English educational philosophies and adapted those principles to the American educational system (Sherow & Wedemeyer, 1990). It is not surprising that distance education has evolved in much the same way. Alternatives to campus-based study began in England during the mid 1850's when Reverend W. Sewell of Exeter College, Oxford, suggested off-campus study through a system of lectures. This concept was expanded in 1871 by James Stuart who proposed a circuit of lecturing professors. This concept became the University Extension System at the University of Cambridge.

The written correspondence course emerged in England as a response to the social taboo on personal interviews between men and women. Professor Stuart replaced the lecture courses for women with printed lessons, a syllabus and examination sheet and conducted the instruction through the mail. Distance education came to the United States when Anna Elliot Ticknor established a similar correspondence course system for women in 1873. The correspondence courses were operated out of her home in Boston, Massachusetts (Sherow & Wedemeyer, 1990).

The mediums used for distance education have changed as technology has evolved. During the 1930's and early 1940's, approximately 20 educational radio stations were broadcasting in the AM band. WOI-TV in Ames, Iowa was the first television station to broadcast educational programming in 1950 (Garrison & Shale, 1990).

By the early 1980's, 71% of the colleges and universities in the United States made use of television (Shiveley, 1982). During this same time period the Public Broadcasting System Adult Learning Service began its telecourse activities. By showing recorded telecourses on Public Television Stations more institutions were able to offer distance education opportunities (Brey, 1991).

During the 1980's several other technological developments increased the availability of distance education mediums. The United States was wired for cable television and video cassette recorders became household consumer items. Full motion television technologies such as Instructional Television Fixed Service and point-to-point microwave gained popularity.

The 1990's have brought CD-ROM, compact disc interactive and digital video interactive technologies (Brey, 1991). The most important technological trend seems to be the integration of communication and computer technology. As communication technology has transcended from an analog technology to more digital transmission and storage methods, it increasingly

resembles computer technology (Simpson, Pugh, & Parchman, 1991).

Distance education technology is accelerating the removal of traditional barriers to competition among post-secondary institutions for students and institutional resources. In 1991, 58% of two-year institutions had a distance education program via telecommunications, 20% were planning a distance education program, while 22% did not have a distance education program. It is expected that by 1994, 80% of all two year institutions will have distance education programs, while only 67% of four year institutions will have distance education programs. The primary reason why two year institutions will not have distance learning programs in the 1990's is the perceived imbalance between costs and income. For universities, it relates more to the institutional mission, although cost remains a factor (Brey, 1991).

The myriad of distance education technologies make it necessary for educational institutions to analyze the educational and cost effectiveness of each method in relationship to their mission and goals to determine which medium to use, this is not a simple task. Hope is offered by the initial evaluation of the Annenberg/CPB Project's New Pathway to a Degree Project. According to Sally M. Johnston, the pioneering institutions' efforts revealed that:

> the specific technologies are less important to the success of a program than are the people variables, the factors that allow faculty and students alike

to function effectively within these new environments (Levine, 1992).

Planning

To establish an effective distance education system there must be a planning process. Allan Hershfield (1986) illustrated the dire consequences of not completing a thoughtful planning process in a case study of the Learn Alaska Network. The State of Alaska invested approximately $30 million to install telecommunications equipment across the State to deliver university, secondary and elementary programs and courses. In 1986, the network was closed.

> "The Alaskan case is, then, almost a classic example of the consequences of focusing on telecommunications technology almost as an end unto itself rather than a means to serve a particular client group" (Hershfield, 1986).

There are many stages in the distance education planning process (Levine, 1992):

1. Determine whether a demand exists for a distance education program and whether the mission of the institution is well served by the development of such a program.

2. Identify policies-both external and internal-that might affect the success of the program and work to eliminate those that might serve as barriers.

3. Build a broad base of support for the legitimacy and value of distance education.

4. Examine the degree programs currently offered at the institution(s) to see which adapt readily to distance education models.

5. Select from among available courseware those instructional packages that meet local needs.

6. Develop locally produced distance education courses to complete degree requirements.

7. Evaluate the cost effectiveness and availability of telecommunications alternatives for content delivery and student-faculty interaction that meet both course objectives and the needs of distance learners.

8. Ensure that student services meet the needs of distance learners.

9. Select excellent faculty and train them in effective distance education teaching methods and in the use of telecommunications technologies.

10. Develop an evaluation plan that involves faculty, administrators and students.

Further examination of the literature gives additional insight into several of these planning stages.

Cost Analysis

It is necessary for rational decision making to relate educational effectiveness to cost. There are times when educators become so excited about an emerging technology that a thorough cost analysis is not done. Since economics is about scarcity, there needs to be a technique for choosing between alternative programs. In economic terms, a cost is a sacrifice of an option. If a resource is applied to one use, it is not available for another use. Costs must be considered in relation to the benefits received (Mace, 1982). Levin

argues that despite the relevance of an analytical approach for assistance in decision making, there is very little use of cost-effectiveness methods in education (Levin, 1981).

Cost-effectiveness analysis uses techniques that combine cost analysis of alternatives with their effects in order to select strategies for adoption or implementation. To determine cost-effectiveness there must exist decision alternatives, a cost analysis of the alternatives must be performed and be accompanied by an evaluation of effectiveness of each alternative. Both the costs and the benefits must be expressed in terms of monetary values, so they can be compared. Cost-effectiveness and cost-benefit are terms that are used interchangeably to refer to a family of analytical techniques used to evaluate the most effective ways to use public resources (Levin, 1981).

There are various models for determining the cost-effectiveness of distance education. Some models appear to address the costs of alternatives while ignoring the benefit side of the equation. When benefits are not quantified in an analysis it must be assumed that the benefits of the alternatives are considered equal.

Generalized statements about the economics of distance education are not possible. Each statement must be differentiated since they may apply to most cases or only to well defined, specific applications. Seemingly similar distance education systems may include different functions and

media. The British Open University includes the use of television and radio, while the German FernUniversitaet does not. Both of these universities have a number of study centers where tutorials and media facilities are available to students. This service is not offered by many other distance education institutions. Some institutions use video recordings or films, while others limit their media to printed materials and audio tapes or discs. Pure correspondence study that relies on the written word can be very inexpensive when offered on the large scale. More sophisticated systems require higher costs per student, even if large numbers of students are provided for (Holmberg, 1989).

In comparing technologically based learning systems and conventional learning systems, John Mace (1982) developed formulas for total cost and for average cost that consider number of students, fixed costs and variable costs. Using these formulas it is possible to determine at what number of students distance education becomes more cost effective than conventional learning systems. Mace also expanded this theory to take into account long term costs that are annualized over the life of the project. This introduces a time dimension that changes the break-even point for distance education compared to conventional delivery systems (Mace, 1982). These formulas are applicable to any delivery method of distance education.

Greville Rumble (1988) argued that the cost structures of distance and traditional education are so different that it is difficult for distance educators to describe the operation and economics of their delivery systems. Rumble asserted that the total cost of distance education is a function of the number of students, the number of courses developed, the number of courses being presented to students and fixed costs of the system. Another factor which affects the cost of distance education systems is the extent of student support services are provided to students (Rumble, 1988). This formula is most effective in costing correspondence, non-interactive broadcasts, computer aided instruction and interactive videodisc programming.

The University of Wisconsin used a very complex method when determining the breakeven point of a prototype distance education course. An ad hoc committee selected a course consisting of a 100 page study guide containing 20 lesson assignments plus a midcourse and final examination. It was assumed that 100 students would enroll in the course over a three-year period, with a completion rate of 48% and a drop-out rate of 52% after two lessons. The committee identified 146 major and minor activities for the total correspondence study procedure. These activities ranged from the initial conception of the course to the issuance of the final transcript for the student. The cost of each activity was determined and analyzed. The accumulation of costs for all

activities provided the committee with total costs associated with the prototype course (Holmberg, 1989).

Another model was developed by Rosenquist for costing a traditional correspondence school. His model uses two components of cost: 1) the course material, and 2) student services. Common costs for course materials include capital costs, warehousing, purchased services, and materials. Added to these is an overhead percentage for fixed organizational costs. The student service component includes costs for publicity, counselling, distribution services, postage, telephone, and tutor fees (Holmberg, 1989).

If distance education programs are offered using a telecommunications system the cost will vary based on the following factors (Duning, VanKekerix, & Zaborowski, 1993):

1. The nature and number of receive and origination sites.
2. The quality and complexity of the equipment used to send or receive program signals.
3. The method of program transport used and the distance required to move programs from origination to receive sites.
4. The degree of interaction designed into the system.
5. The nature of the instructional and support staff.
6. Whether the system is a full-time (dedicated) or part-time operation.
7. The level of reliability required.
8. The electronic technology selected.

Using these criteria to judge an entire system would result in a generalization that distance education technology would be ranked in cost from lowest one (1) to highest four (4) as follows:

1. Non-electronic systems (Correspondence study)
2. Audio systems
3. Computer-based systems
4. Video systems

Educational telecommunications systems are assumed to be expensive. Although this myth is often voiced, the reality is that the cost of telecommunications-based education ranges widely depending on the electronic technology used in the design of the system. The distance education telecommunication system is comprised of: a receive site, an origination site, send and receive equipment, transport of information, interactivity, and staffing. In each segment of the system there are numerous decisions that have various performance and financial implications which will impact the fiscal stability of the telecommunications system. In addition to the system considerations, the reliability of the system will be impacted by the decision as to the level of program activity. Dedicated systems are more reliable than on-demand systems, but do require a commitment of

staff and fiscal resources (Duning, VanKekerix, & Zaborowski, 1993).

There is a need to plan not only for the hardware and technical configuration of the system, but also the following (Gunawardena, 1990):

1. Long-term financing to keep the system operational as opposed to merely start-up costs.

2. User density, i.e. the availability of a sufficient number of users to make the system cost effective.

3. Decisions regarding what campus unit would be responsible for paying for the programming.

4. Facilities to house the hardware and staff for the system.

5. Financial arrangements with the sending or receiving institutions and the equipment available at those institutions.

From studying several cost analysis models Keegan (1986) developed the following generalizations on the costing of distance education:

1. The economics of conventional education is of little value for the cost analysis of distance education.

2. The proportion of fixed costs to total costs in conventional education is small; this is not true of distance systems.

3. Distance systems, like industries, have high capital investment in the production of courses; conventional education is labor intensive.

4. The number of drop-outs in the system is crucial; once drop-outs pass 50% and move towards 100% cost-effectiveness vanishes.

5. If student support services are face-to-face and compulsory, cost structures rapidly return toward those of conventional education. Some authors appear to suggest that academic success or reduction of drop-out may be linked to provision of student services (Keegan, 1986).

The models discussed previously are based on the economist's approach which uses a small number of variables and does not analyze costs in sufficient detail. Activity costing models uses the accountant's approach and analyzes costs through the accounting and budgeting systems. This aggressive approach assigns all costs within the accounting system, both direct and indirect, to each course (Rumble, 1986 a). Typically, the accounting and budgeting systems of educational institutions do not support this type of analysis. Costs are usually allocated to organizational units (departments or divisions) rather than courses. The amount of work necessary to overhaul an institution's accounting and budgeting system so that this model could be used would be significant.

Some researchers have offered models that evaluate the relationships between the many functions that make up a comprehensive distance education system. Saba and Twitchell (1988) suggested a system modeling approach that provides four types of information that may not be attainable through tradition cost analysis.

1. How one part of the system affects the other parts and is affected by the other parts,

2. How each part as well as all parts, collectively, help or hinder the system achieve its goals,

3. How the system interacts with its social context (environment), and

4. What alternative policies move the system towards its goals in the future.

System dynamics is a technique that translates intuitive models into causal-loop diagrams which depict the effect of one system function on other affected functions through positive or negative feedback loops. Flow diagrams are developed on each system function, then translated into a set of mathematical equations. Using this type of model questions can be answered such as (Saba & Twitchell, 1988):

1. Does the initial number of students enrolled in a distance education system affect the resources allocated to the system?

2. How do resources available to the system affect the performance of each system function

Woudstra and Powell (1989) suggested that value chain analysis can be used to gauge, analyze and predict how efforts to control costs affect the achievement of strategic organizational objectives. The value chain analysis can enable an institution to accomplish its mission through cost-effectiveness or differentiation. Value chains represent the collection of activities performed in the institution to design, produce, market, deliver, and support its products.

They break an organization into its relevant activities and provides a framework for understanding the behavior of costs.

The use of value chain analysis by distance education institutions can encourage managers to (Woudstra & Powell, 1989):

1. Systematically consider the effects of policies, decisions, and actions on all areas of the organization through awareness of inter-relationships and linkages found throughout the organization.

2. Systematically consider the effects of policies and decisions on the organization's value system and potential strategic alliances with suppliers, buyers, and even potential or current competitors.

3. Carefully determine the cost drivers for all activities and their effect on the cost, quality and perceived value of the organization's programs, courses, and services.

4. Make decisions and set policies from a future-oriented perspective.

Cost analysis studies, usually in the area of staff training, have also been done comparing costs of education delivered at a central site versus the same training being provided via telecommunications technology. The studies contrast the cost of providing distance education with the cost of staff travel to the central site and the provision of replacement personnel, or the cost of bringing instructors to the remote location (Rule, et al., 1989), (Simpson, 1992). The studies found there to be a cost benefit to using the distance education technology.

Because a higher education institution does not pay to bring students to the institution, they do not factor transportation costs into their cost of providing instruction using conventional methods. There should, however, be a method within the decision making process to consider the cost benefit to the distance education student of the decreased travel time and expense, and loss of work hours. Ansari (1992) defines these costs as private costs.

Included in private costs are the payment of tuition and fees, purchase of reading materials, stationery, travel, postage, and other personal and maintenance costs. Also contained in private costs are the value of a foregone opportunity. The focus of most studies in the economics of education have been on the analysis of the cost of educational programs while the benefits to the individual and/or society have been assumed to be equal to the private costs (Ansari, 1992).

Cost-effectiveness and cost-benefit analysis enable a choice to be made among alternative strategies for providing educational opportunities. There are situations in which the estimate of costs, alone, are important. Cost-feasibility analysis is a method of estimating costs of an alternative in order to determine whether or not it can be considered. If the costs exceed the available resources there is no point of doing further analysis of effectiveness (Levin, 1981).

Faculty Issues

The educational effectiveness of distance education, specifically interactive televised instruction, is high. Studies focusing specifically on interactive distance education revealed that there are no significant differences in academic performance for students in technologically delivered courses and traditional classroom settings (Gehlauf, et al, 1991), (Verduin & Clark, 1991). Researchers have acknowledged the differences in instructional techniques in the two settings. Most importantly, the array of technologies create opportunities for faculty to rethink content and make new decisions on how to present content (Levine, 1992). Time and effort must be put into developing in faculty the necessary technological skills and abilities to effectively present instruction in the interactive setting.

Distance education technology causes instructors to make changes in familiar teaching patterns. Negative faculty attitudes are a barrier to successful implementation of distance education. It appears, according to Verduin and Clark (1991), that those educators involved with some phase of distance education feel strongly about its use and potential, while those with little knowledge or use question its viability. The key to greater acceptability is to encourage more knowledge.

Incentives are needed to encourage participation by faculty (Dillon, 1989). Faculty selection and the extra

effort made to entice quality faculty in the early stages of developing a distance education project in West Virginia provided credibility and long-term payoffs. The ACE/Alliance Principles of Good Practice include the following two principles that relate to faculty selection (Levine, 1992):

1. Criteria, rationale, and procedures for the selection and evaluation of faculty and academic professionals in the program are congruent with the standards of the institution.

2. Specific criteria, standards and expectations for the role of part-time or adjunct faculty are clearly articulated.

The state of Oregon uses the following criteria in selecting distance faculty (Levine,1992):

1. They should be relatively senior people, highly visible, respected by their peers.

2. They should be known to be good teachers.

3. They should like the idea of distance learning and want to participate in it.

Some faculty will embrace the opportunity to experiment with the technology and see it as a way to develop themselves and improve their courses. Others will need incentives to become involved. Incentives can be in many forms, such as (Levine, 1992):

1. Financial incentives - Cash, release time, overload pay, equating one distance education course to two on-campus courses.

2. Administrative support - such as secretarial support or teaching assistants.

3. Faculty appraisal - make distance teaching count in consideration for reappointment, promotion and tenure.

4. Training - special training opportunities should be available.

5. Promotion - a system exists to promote and disseminate the success and enjoyment of the distance education faculty experience.

6. Opportunities - create opportunities for faculty networking and peer recognition.

7. Protection - minimize the risk of failure.

Distance educators must spend additional time preparing and planning lessons so that they are effective within the technology they are delivered. This may result in compacting the amount of information transmitted within the instructional time unit and subsequently allow more quality time-on-task learning situations. It is clear that students should not accept a simple transfer of old teaching methods to new technology. Adult students cannot be expected to respond positively to a "talking head" lecture style presentation. It is essential to the success of a distance education program that quality faculty are recruited, retained and trained.

Evaluation

Even though there are many approaches to offering distance education, its effectiveness should be measured using consistent criteria (Johnson, 1986):

1. Student learning of information and understanding. This is usually measured by academic assessments.

2. Student satisfaction with content and process of the course. This is usually measured by a student questionnaire.

3. Retention rates and graduation rates.

4. Employability or advancement within employment.

Richard Johnson (1986) suggests that there are eight distance education activities whose outcomes need to be judged against the four criteria to evaluate effectiveness:

1. Academic production: The decisions on course content and topics, educational approach, examples, exercise and practical work, which ultimately depend on the educational goals of the course and the philosophy of the teachers.

2. Materials production: The production of the written materials, illustrations, audiovisual materials, kits and so on.

3. Distribution: By mail or broadcast or facsimile or computer or whatever; to individual students or to regional centers used by groups of students.

4. Interaction: Of student with teacher or with other students; by mail, telephone, computer etc; individually or in groups; at a distance (through teleconference) or face-to-face.

5. Exercise: Readings, library materials, practical work, work experience, assignments.

6. Assessment: To diagnose student learning, to gauge student progress, to measure student attainment.

7. Evaluation: Of course content, course materials, methods of presentation, delivery, student support systems; the possible need for changes to any of these.

8. Student support/guidance: Before enrollment or during course; educational and psychological support; by academic and general staff and by other students or other people.

This study will apply established theories of distance education to evaluate the long term feasibility of

Northwestern Michigan College utilizing distance education technology. An evaluation of the planning process will be made with the emphasis on evaluating cost effectiveness and program effectiveness.

CHAPTER III

Methodology

This study is an evaluation study that uses decision-oriented and cost-oriented approaches (McMillan & Schumacher, 1989). Needs assessments were completed to evaluate the need for expanded advanced degree offerings in the area served by Northwestern Michigan College and the receptiveness to the use of distance education technology to provide those additional educational opportunities. A cost analysis of distance education was completed using cost-feasibility analysis (Levin, 1981). To assist in developing a funding program for the construction of a University Center a pre-campaign audit was conducted by a consultant hired by Northwestern Michigan College.

Historical data for this study was collected from several types of data sources which included: literature searches, independent studies, and surveys. The literature searches were conducted at the Library of Congress, Washington, D. C., Ferris State University, Michigan State University, Central Michigan University, Western Michigan University, the Educational Resources Information Center (ERIC), the 1990 United States Census, and national organizations concerned with higher education and distance education issues. The literature searches identified planning models and cost

analysis methods used for distance education that are applied in this study.

Independent studies and surveys on the need for higher education in the Grand Traverse region were conducted by the Grand Traverse Area Chamber of Commerce, Grand Traverse County Board of Commissioners, the Michigan Department of Education's Project Outreach, Northwestern Michigan College, The Traverse Bay Economic Development Corporation, and the school Superintendents from the local school districts comprising the Traverse Bay Area Intermediate School District.

In 1990 the Grand Traverse County Board of Commissioners sponsored a project called, "Grand Traverse 20/20". The project was part of the County's updating of the Comprehensive Land Use Plan. Twenty futuring sessions from a broad cross-section of residents were held to provide input to the planners as they outlined their vision for the community in the year 2000. The results were published in a summary report issued in May 1991.

Numerous opinion surveys have been conducted in the Grand Traverse region by the Project Outreach staff, the opinion research arm of the Michigan Department of Education. The questionnaires used for all of the surveys were developed by Ned S. Hubbell, APR, Consultant for Project Outreach. Input for questionnaire content was enriched by suggestions from focus groups at Northwestern Michigan College. All telephone interviewing was conducted by professional interviewers in

Lansing, using the Outreach WATS line facilities. Interviewing was conducted in the evening between 5:30 p.m. and 9:30 p.m.. All data was read, coded, tabulated, and tabulated in Lansing by the Outreach staff.

The first opinion survey of students enrolled at Northwestern Michigan College was conducted by telephone interviewing from April 15 through 18, 1991 by the professional staff of Project Outreach in Lansing,. The survey was one of three such projects authorized by college officials which sought the opinions and attitudes from community groups about Northwestern Michigan College.

Student enrollments at Northwestern Michigan College were almost evenly divided between full-time and part-time students therefore it was decided to draw a sample consisting equally of full-time and part-time students. Winter term enrollment listed 3,973 students. A sample of 200 full-time students was randomly selected by systematic random sampling procedures from the listing of 1,958 students (49%). Such a sample is based upon a 95% confidence that the sample is representative of all full-time students, with a sampling error of 7%.

From the same term listing of 2,015 part-time students (51%), a sample of 200 part-time students was also selected by systematic random sampling procedures, with the same level of confidence and sampling error as the full-time student sample. Sampling error for all 400 students was 5%.

The second phase of the 1991 Project Outreach survey project authorized by Northwestern Michigan College was conducted during the week of April 22, 1991. Citizen opinions and perceptions of Northwestern Michigan College were obtained in a telephone opinion survey of adult residents of Grand Traverse County.

A survey sample of 400 respondents was generated by a computer in a random sampling process known as Random Digit Dialing, so that all listed and unlisted telephone households in Grand Traverse County had an equal chance of being included in the probability sample. Sample size of 400 is based upon a 95% confidence, subject to a sampling error of 5%. One adult (18 years of age and older) in each household was selected for interviewing, based upon use of a Respondent Selection Table, developed by Kish (1982). The average length of the telephone interview was 20 minutes.

Opinions of the faculty and staff of Northwestern Michigan College were obtained through a third telephone opinion survey conducted by Project Outreach in 1991. All 371 employees who had telephone service in their home were called by Project Outreach professional interviewers during the evening hours of 5:30 p.m. to 9:30 p.m. May 6 through 10, and May 13, 1991. Call-back appointments were made when necessary for the convenience of employees and interviews were completed with 300 total employees, or 81% of the total staff. Such a

sample size permits generalizations to all employees with a 95% confidence factor and a sampling error of 5.7%.

In 1992 the Michigan Department of Education Project Outreach staff surveyed former Northwestern Michigan College students. This was a part of the second statewide opinion survey of former community college students conducted by the Project Outreach staff. The survey sought the opinions of community college students who were enrolled for at least one class during the 1990-91 school year but did not return during Fall term/semester of 1991. The survey took place between May 11 and May 28, 1992.

The sampling framework was developed the Project Outreach staff of the Michigan Department of Education. Twenty-seven of the twenty-nine Michigan community colleges participated. Two separate subgroups comprised of 200 full-time and 200 part-time students were established within each of three clusters (urban, suburban, and regional colleges). Survey respondents were selected by simple random sampling procedures. Sampling was based upon a 95% confidence level with the following sampling errors listed in Table 1.

Under the supervision of Project Outreach staff, twenty experienced interviewers conducted the telephone survey interviews between the hours of 5:00 p.m. and 9:30 p.m. Interviews ranged from ten to fifteen minutes. The questionnaire was developed by the Project Outreach staff,

after receiving input from the State Board of Education, educational policy makers, researchers, public relations

Table 1

Sampling Error for Survey of Former Students

Respondent Group	n	Sampling Error %
All former student respondents	1,200	3.0%
Full-time former students	600	4.0%
Part-time former students	600	4.0%
Urban/Suburban/Regional	1,200	4.9%
Graduates	216	8.0%
Transferred students	253	7.0%
Selected courses only	131	9.0%
Job changes	161	9.0%
Personal changes	273	7.0%
College related dissatisfaction/other	166	7.0%

professionals, and instructional staff members from a variety of community colleges throughout Michigan.

All survey data was read and coded by Project Outreach staff, and was tabulated through the computer facilities of the Michigan Department of Education. Results were analyzed and interpreted by the Project Outreach staff who prepared the report.

In 1992 the Michigan Department of Education surveyed students enrolled at Northwestern Michigan College. This was part of the third statewide opinion survey of enrolled community college students conducted by Project Outreach. The survey sought the opinions of community college students who

were enrolled during Spring term/semester 1992. The survey took place between April 21 and May 5, 1992.

The sampling framework was first developed in 1988 by the Project Outreach staff of the Michigan Department of Education. All 29 Michigan community colleges participated. Two separate subgroups comprised of 200 full-time and 200 part-time students were established within each of three clusters (urban, suburban, and regional colleges). Survey respondents were selected by each of the 29 colleges based on systematic random sampling instructions from Project Outreach. Sampling was based upon a 95% confidence level with the following sampling errors listed in Table 2.

Table 2

Sampling Error for Students Enrolled at NMC

Respondents	n	Sampling Error %
All student respondents	1,200	3.0%
Full-time students	600	4.0%
Part-time students	600	4.0%
Urban/Suburban/Regional	400	4.9%

Under the supervision of Project Outreach staff, twenty experienced interviewers conducted the telephone survey interviews between the hours of 5:30 p.m. and 9:30 p.m. from the offices of the Ingham Intermediate School District in Mason, Michigan. The questionnaire was developed by Project Outreach staff, after receiving input from the State Board of Education, educational policy makers, researchers, public

relations professionals, and instructional staff members from a variety of community colleges throughout Michigan.

All survey data was read and coded by Project Outreach staff, and was tabulated through the computer facilities of the Michigan Department of Education. Results were analyzed and interpreted by Project Outreach staff who prepared the report.

The Traverse Bay Economic Development Corporation in September, 1992 studied the service sector businesses. Surveys were distributed to all service sector businesses in the Grand Traverse region to determine the needs of the service oriented businesses. The surveys were pre-tested with a limited sample of businesses prior to the mass distribution. to all businesses. The rate of return for the survey was 62%.

In September and October, 1992 a series of sixteen educational forums were presented throughout the five county area for 237 residents to learn and discuss the concept of developing a University Center, at Northwestern Michigan College. They were informed about the interest from the college to provide undergraduate and graduate courses and degrees from various State universities. It was assumed that those attending the forums would be very favorable to the concept of an University Center and the purpose of the study was to survey those in attendance to determine if issues such as: 1) if part-time or full-time attendance was an issue, 2) are the responses different for gender, age, or county of

residence, 3) was attendance at local high schools using compressed interactive video technology a concern, and 4) were there barriers perceived to exist which would keep students from registering for classes. The results of this study helped determine the issues to be considered prior to designing and ultimately conducting the additional surveys of area residents, area high school students, and students enrolled at Northwestern Michigan College.

Residents were told that the University Center would provide four-year and advanced degree programs, continuing education classes and professional development programs in fields such as education, insurance, real estate, medicine, law, hospitality, job training and re-training. High school dual enrollment classes, curriculum enrichment classes, and personal enrichment programs would also be provided by the universities. At the end of each presentation, citizens attending the forums were requested to complete, prior to leaving the forum meeting, a Community Forum Survey.

Fifteen variables were identified for the forum survey, questions were developed for each variable, and anticipated responses were developed and provided after each question. Responses were coded, at the nominal level, for analysis purposes. The survey instrument was then field tested with ten residents and adjustments were made to improve the clarity of the survey questions prior to the first forum meeting. Survey responses were entered into the Western Michigan

University VAX computer and analysis of selected variables was done using the SPSS statistical data analysis software.

In November of 1992 the Founders 21 University Center Phone Survey was conducted. The survey instrument was developed and sample specifications were established by William J. Banach Associates, Inc. The survey was designed to produce a confidence level of 95% plus or minus 4.5% sampling error at the 50:50 split. The survey instrument was pretested prior to administration. During the week of November 9, 1992 trained volunteers conducted telephone interviews from the Northwestern Michigan College campus. The survey project targeted adult households in the five-county northwestern Michigan area.

During September and October of 1992, juniors and seniors from the fifteen public high schools and one private high school in the five county intermediate school district were surveyed to determine the students' interest in attending college, type of high school program students were enrolled in, and where were the students planning to attend college. It was the premise of this study that high school students would be very favorable to the concept of attending Northwestern Michigan College, if they could continue the second two years of undergraduate college from a university offering credit programs in the five county region of northwestern Michigan. The purpose of this study was to survey the junior and senior class to determine: 1) types of

secondary programs in which high school junior and senior students were enrolled, 2) student work and educational plans after graduation, 3) types of advanced degrees high school students are planning to earn, and 4) if Northwestern Michigan College provided third and fourth year university courses through a University Center, would students from the five county region be interested in attending such a program. Students were requested to complete a Founders 21 Survey of Northwestern Michigan High School Students.

Fourteen variables were identified for the student survey, questions were developed for each variable, and anticipated responses were developed and responses were provided after each question. Responses were coded for data analysis purposes. The survey instrument was then field tested with ten randomly selected students who were informed about the University Center and adjustments were made to improve the clarity of the survey instrument prior to survey distribution. Survey responses were recorded on scantron answer sheets, processed using a MS-DOS computer system, and then data was transmitted into the Western Michigan University VAX computer using the file transfer program. Analysis of selected variables was done using the SPSS statistical data analysis software, release 4.1.

Cross tabulations of row, column, expected values, and total percentages were calculated to obtain information about the relationships between various variables surveyed, using

the SPSS Statistical Data Analysis, release 4.1 for the VAX/VMS computer located at Western Michigan University. An alpha level of 0.05 was established for the testing of all hypothesis.

During the fall 1992, students enrolled in courses at Northwestern Michigan College were surveyed to determine the students' interest in attending the University Center. It was the premise of the study that the college students would be very favorable to continuing the second two years of college at the university center, if programs being offered were in the student's areas of interest. The purpose of this study was to survey the college student's to determine: 1) types of degree programs the students were enrolled in, 2) student educational plans after graduation or transfer from Northwestern Michigan College, 3) types of advanced degrees the college students were planning to earn, and 4) if Northwestern Michigan College provided third and fourth year university courses through a University Center, would students be interested in attending such a program. The results of this study provided information about student interest in local access to higher education programs. The sample for this study comprised 637 college students from selected courses. Students were told that the University Center project would provide third and fourth-year undergraduate degree programs as well as advanced degree programs. Students

were requested to complete a Founders 21 Survey of Northwestern Michigan College Students.

Fourteen variables were identified for the college student survey, questions were developed for each variable, and anticipated responses were developed and responses were provided after each question. Responses were coded for data analysis purposes. The survey instrument was then field tested with ten randomly selected college students who were informed about the University Center and adjustments were made to improve the clarity of the survey instrument prior to survey distribution. Survey responses were recorded on scantron answer sheets, processed using a MS-DOS computer system, and then data was transmitted into the Western Michigan University VAX computer using the file transfer program. Analysis of selected variables was done using the SPSS statistical data analysis software, release 4.1.

Cross tabulations of row, column, expected values, and total percentages were calculated to obtain information about the relationships between various variables surveyed, using the SPSS Statistical Data Analysis, release 4.1 for the VAX/VMS computer located at Western Michigan University. An alpha level of 0.05 was established for the testing of all hypothesis.

In the Fall of 1992 the Grand Traverse Area Chamber of Commerce mailed a survey to 271 Chamber of Commerce members to respond to questions regarding their understanding and need

for higher education undergraduate and graduate courses and degrees. Eighteen variables were identified for the Chamber survey, questions were developed for each variable, and anticipated responses were developed and responses were provided after each question. Responses were coded for data analysis purposes. The survey instrument was then field tested with ten randomly selected Chamber members who were informed about the University Center and adjustments were made to improve the clarity of the survey instrument prior to survey distribution. Survey responses were recorded on scantron answer sheets, processed using a MS-DOS computer system, and then data was transmitted into the Western Michigan University VAX computer using the file transfer program. Analysis of selected variables was done using the SPSS statistical data analysis software, release 4.1.

Cross tabulations of row, column, expected values, and total percentages were calculated to obtain information about the relationships between various variables surveyed, using the SPSS Statistical Data Analysis, release 4.1 for the VAX/VMS computer located at Western Michigan University. An alpha level of 0.05 was established for the testing of all hypothesis.

In October 1993, school superintendents from the fifteen local public school districts within the Traverse Bay Area Intermediate School district discussed their educational priorities for the next five to ten years at their Fall

retreat. The group was divided into six small discussion groups and each group was asked to develop educational needs priority lists. After the six priority lists were presented to all of the superintendents, matched pair analysis was used to determine the final ranking of all of the educational needs priorities for the fifteen school districts.

In the summer of 1993, Monaghan Associates Inc. performed a pre-campaign audit for the exclusive use of Northwestern Michigan College to assist the College in making decisions regarding a funding campaign for the construction of a University Center. The consultants reviewed Northwestern Michigan College's history including financial data, long-range plan, services, and programs. They determined potential interview candidates, scheduled and conducted 39 confidential interviews.

A series of open-ended questions were asked in each interview. All interviews were pre-scheduled and conducted in a private, confidential setting. Upon completion of all the defined interviews, respondent perceptions and concerns were gathered and, with other materials and informational data, were assessed and evaluated by combined personnel within Monaghan Associates. A report was submitted to Northwestern Michigan College that included favorable and unfavorable factors, conclusions, recommendations and a tentative campaign schedule.

During the 1992-93 academic year, Northwestern Michigan College piloted several two-way interactive classes between the main campus and the Cadillac campus located forty-five miles south east of Traverse City. Survey questions were developed, and anticipated responses were developed and responses were provided after each question. Responses were coded for data analysis purposes. The survey instrument was then field tested with randomly selected college students who were informed about the University Center. Adjustments were made to improve the clarity of the survey instrument prior to survey distribution. Survey responses were recorded on scantron answer sheets, processed using a MS-DOS computer system, and then data was transmitted into the Western Michigan University VAX computer using the file transfer program. Analysis of selected variables was done using the SPSS statistical data analysis software, release 4.1.

A cost analysis of two-way interactive video was completed using cost-feasibility analysis (Levin, 1981). Cost-benefit and cost-effectiveness were not completed because of the difficulty in measuring benefits and program outcomes. The cost data was collected through discussions with Northwestern Michigan College's Directors of Media Services and Information Technology Services, and Vice President for Administrative Services. Costs were also obtained from documents submitted to the Michigan Department of Management and Budget and to the Kellogg Foundation by the college.

CHAPTER IV

Research Findings

The purpose of the study is to determine the long-term financial and educational feasibility of Northwestern Michigan College utilizing in distance education technology. It is expected that the results of this study will offer insight for other educational institutions formulating distance education strategies.

This study will answer the following research questions:

1. Is there a need for expanded educational opportunities in the region Northwestern Michigan College serves?

According to the 1990 U.S. Census, the percent of high school graduates for the five county area was 78.5%, or 1.7% greater than the State total of 76.8% of high school graduates. The percent of bachelor degrees or higher for the five county area was 16.4%, which was 1.0% lower than the State total of 17.4%. In addition to lower percentage of residents having four-year degrees, the per capita income was $3,680 lower; $11,474 as compared to the State per capita income of $15,154.

In 1990 the Grand Traverse County Board of Commissioners sponsored a project called, Grand Traverse 20/20. The project was part of the County's updating of the Comprehensive Land Use Plan. Twenty futuring sessions from a broad cross-section of residents were held to provide input to the planners as

they outlined their vision for the community in the year 2000. In the area of education, the vision clearly stated the desire for Northwestern Michigan College to become a university, or for the college to expand the opportunities for advanced degree courses and programs for the region.

According to a Michigan Department of Education Project Outreach Survey of students enrolled at Northwestern Michigan College during the winter term of 1991 (Project Outreach, 1991) 46.0% of all enrolled students had university transfer credit as their primary educational goal. The Michigan Department of Education Project Outreach Survey of Grand Traverse area residents in 1991 (Project Outreach, 1991) stated that 81.0% of the respondents said it was important or somewhat important that four-year college classes be expanded in the Traverse City area, 88.0% indicated that a college education was very important, 65.0% of the residents stated that they would take more college courses in Traverse City if there was a greater variety of courses and programs offered, and 57.0% of the respondents wanted the college offerings close to home.

A study of former community college students (Project Outreach, 1991) indicated that 21.0% of the former students did not re-enroll at community colleges because they transferred to a four-year institution. Transfer was listed as the primary educational goal of 31.0% of the former community college students. The 1992 Michigan Department of

Education Project Outreach Statewide Survey of enrolled community college students indicated that 43.0% of the students planned to transfer to a four-year school as their primary educational goal (Project Outreach, 1992).

The Grand Traverse Area Chamber of Commerce surveyed their membership in the fall of 1992. Fifty-one percent of the membership indicated that their business required continuing education. Sixty-five percent of the membership stated that the associates degree was either required or very important for their employees. Thirty-six percent of the membership reported that an undergraduate degree was required and 34% indicated that a graduate degree was either required or very important.

The Traverse Bay Economic Development Corporation in 1992 studied the service sector businesses and identified three primary areas of need: additional office building space, skilled labor, and expanded baccalaureate and advanced degree offerings. The report indicated that the lack of baccalaureate programs was one of the impediments to business growth.

In September and October, 1992 a series of sixteen educational forums were presented throughout the five county area for 237 residents to learn and discuss the concept of developing a University Center, at Northwestern Michigan College. They were informed about the interest from the

college to provide undergraduate and graduate courses and degrees from the State universities.

Cross tabulations of row, column and table percentages were calculated to obtain information about the relationships between various variables surveyed, using the SPSS statistical data analysis. When asked of those in attendance at the forums, 99.6% indicated that they believed an University Center is important to the future of northwestern Michigan with 90.7% stating that they would enroll if provided such a center.

During September and October of 1992, 1,781 juniors and seniors from the fifteen public high schools and one private high school in the five county region were surveyed to determine their interest in attending college. The type of high school program the students were enrolled in and where the students planning to attend college was obtained.

The results of this study provided information about student interest in local access to higher education programs. The sample for this study comprised high school students (n=1,781) from the one private and fifteen public high schools in Northwestern Michigan College's service region of Antrim, Benzie, Grand Traverse, Kalkaska, and Leelanau counties. Students were told that the University Center project would provide third and fourth-year upper division undergraduate degree courses and programs as well as advanced degree programs. The sample was distributed 49.5% males and 50.5%

females and 51.1% juniors, 46.8% seniors with 2.1% of the students not indicating their class level.

Students were asked to indicate in what type of secondary curriculum they were enrolled (Table 3). Sixty one percent of the students indicated that they were enrolled in college preparation courses with percentages for local high schools ranging from 19.2% to 88.5%. The high school students sampled were asked what their plans were after graduation from high school; the majority, 54.3% indicated full-time attendance at a college with an additional 22.5% planning to work and attend college on a part-time basis. Crosstabs analysis was computed between their plans after graduation variable and

Table 3

Type of Program High School Juniors and Seniors are Enrolled in.

Row % Column %	General Programs	Vocational Programs	College Preparation	Other	Totals Row
Juniors	23.8% 55.0%	14.0% 53.2%	59.5% 50.5%	2.7% 61.5%	52.1%
Seniors	21.2% 45.0%	13.5% 46.8%	63.5% 49.5%	1.8% 38.5%	47.9%
Totals	22.6%	13.8%	61.4%	2.3%	100.0%

the current high school program variable (Table 4). To determine if the two variables were statistically independent, expected frequencies were calculated. Fifteen percent of the

crosstabs cells had expected frequencies of less than five, therefore it is not possible to determine if the variables are independent. Eighty-one percent of the students indicated who plan to attend college on a full-time basis were enrolled in a high school college preparatory program; an additional 12.6% were enrolled in general high school studies. High school students enrolled in college preparatory classes and indicating that they were not attending college after graduation were asked if they thought that they would attend

Table 4

Plans after Graduation by Programs

High School Students are Enrolled in.

Row % Column %	General Programs	Vocational Programs	College Preparation	Other	Totals Row
Work Full-time	44.3% 14.7%	41.8% 22.6%	11.5% 1.4%	2.5% 10.7%	7.4%
Join Military	37.1% 9.8%	27.8% 11.9%	30.9% 2.9%	4.1% 14.3%	5.9%
Trade Schools	37.7% 7.9%	40.3% 13.7%	20.8% 1.5%	1.3% 3.6%	4.7%
College Full-time	12.6% 33.0%	4.6% 19.5%	81.6% 76.0%	1.2% 42.9%	58.2%
Work and College	32.1% 34.6%	18.4% 32.3%	47.5% 18.2%	2.0% 28.6%	47.9%
Totals	22.2%	13.7%	62.5%	1.7%	100.0%

college later in life. Fifty-four percent indicated they would go to college later in life; 27.8% stated that they would not go to college at all, and 17.9% did not know what their plans would be regarding college.

The high school students, planning to go college were asked what type of college degree they were planning to receive. Fourteen percent indicated interest in the associates degree, 45.2% indicated interest in bachelors degrees and 34.3% anticipated receiving at least a masters degree. The crosstabs analysis was computed between the type of degree variable students plan to get and the current high school program variable. To determine if the two variables were statistically independent, expected frequencies were calculated. Twelve percent of the crosstabs cells had expected frequencies of less than five, therefore it was not possible to determine if the variables are independent. The computations did reveal that the students enrolled in college preparatory courses were almost evenly distributed with regards to their degree plans. Forty-five percent were planning to earn bachelor degrees, 42.8% were planning to earn a masters or higher degrees, and 9.2% were planning to earn associate degrees. The largest group, by percent distribution, planning to earn associate degrees, were students enrolled in vocational programs (31.9%), next largest was students taking the general educational classes (20.2%) (Table 5).

Students were asked where they planned to attend college. Twenty-three percent indicated that they planned on attending Northwestern Michigan College, the second largest percentage was planning on attending Michigan State University (8.4%), and the third largest percentage was attendance at private colleges (8.2%). Students were also asked if would consider attending Northwestern Michigan College for the first two years, then transfer to another college or university for the third and fourth year if the four-year college or university

Table 5

Type of Degree by Program

High School Students are Planning to Get.

Row % Column %	General Programs	Vocational Programs	College Preparation	Other	Totals Row
AA/AAS	27.7%	24.9%	41.3%	6.1%	14.8%
Degree	20.2%	31.9%	9.2%	50.0%	
BA	21.2%	10.5%	67.1%	1.2%	45.2%
Degree	47.3%	41.0%	45.7%	30.8%	
MA or PhD	12.3%	4.0%	82.8%	0.8%	34.3%
Degree	20.9%	12.0%	42.8%	15.4%	
No	41.5%	30.5%	26.8%	1.5%	5.7%
Degree	11.6%	15.1%	2.3%	3.8%	
Totals	20.3%	11.5%	66.4%	1.8%	100.0%

provided the classes at the Northwestern Michigan College campus through a University Center program. Seventy-five percent of all the students sampled responded to the question. Of those responding, 40% stated that they would attend Northwestern Michigan College for two years and then transfer to a four-year institution, providing classes were at the University Center located on the campus of Northwestern Michigan College; 60% responded that they were planning to go to the campus of a college or university for all of the four years of their education. Table 6 summarizes the results. To determine if the two variables were statistically

Table 6

Attendance at Northwestern Michigan College for Two Years and University Center for Two Years by Program Areas.

Row % Column %	General Programs	Vocational Programs	College Preparation	Other	Totals Row
NMC 2yrs	28.2%	16.4%	53.7%	1.7%	39.9%
UC 2yrs	54.0%	58.4%	32.3%	42.9%	
4yrs at	16.0%	7.8%	74.8%	1.5%	60.1%
College	46.0%	41.6%	67.7%	57.1%	
Totals	20.9%	11.2%	66.3%	1.6%	100.0%

independent, minimum expected frequencies were calculated; there were no crosstabs cells with expected frequencies of five or less, therefore it is possible that the variables are independent.

During the fall 1992, 637 students enrolled in courses at Northwestern Michigan College were surveyed to determine the students' interest in attending university center courses in Traverse City. The sample was distributed 43.0% males and 57.0% females with 36.5% enrolled as full time students and 63.5% enrolled as part time students. The students were asked why they were attending Northwestern Michigan College. Fifty-six percent planned to transfer to a four-year university, 35% indicated that they planned to either get a job or earn an associate degree, and 9% did not have any response. Sixty-nine percent of the students planning to attend a college or university after completing their studies at Northwestern Michigan College stated that they were planning to earn a masters degree as their ultimate goal. When asked if they preferred to complete the four-year degree in Traverse City, 71% indicated that they would complete the degree in Traverse City if the program and courses were offered. Sixty-four percent of those responding stated that they would attend the university center on a part-time basis.

2. What are the perceived benefits of using distance education?

The educational effectiveness of distance education, specifically interactive televised instruction, is high. Studies focusing specifically on interactive distance education revealed that there are no significant differences in academic performance for students in technologically delivered courses and traditional classroom settings (Gehlauf, et al., 1991), (Verduin & Clark, 1991). Researchers have acknowledged the differences in instructional techniques in the two settings. Most importantly, the array of technologies create opportunities for faculty to rethink content and make new decisions on how to present content (Levine, 1992).

One of the findings of the Project Outreach surveys was the significant level of interest in four-year courses being offered in the Traverse City area. The Michigan Department of Education Project Outreach Survey of Grand Traverse area residents in 1991 (Project Outreach, 1991) stated that 81.0% of the respondents said it was important or somewhat important that four-year college classes be expanded in the Traverse City area, 88.0% indicated that a college education was very important, 65.0% of the residents stated that they would take more college courses in Traverse City if there was a greater variety of courses and programs offered, and 57.0% of the respondents wanted the college offerings close to home.

Similar interest was expressed at the Community forums. Respondents were asked if they had a preference as to location of the courses; either at the Northwestern Michigan College

Traverse City campus or at local high schools using distance education technologies. Cross tabulations were calculated between location of courses, part-time or full-time attendance, age of respondences, and gender. In all three computations, the support for classes to be held at the campus was 81.4% and the support for classes to be conducted at the local high schools was 82.2%.

Distance education is the method to meet the need for course offerings close to home. The two-way interactive video and audio system used by Northwestern Michigan College can bring courses closer to students' homes. Included in the proposal for a University Center is the technology necessary to provide interactive classrooms in fifteen local high schools. Courses are currently being offered in Cadillac, Michigan that would otherwise not be available because of low enrollment.

Student's enrolled in Northwestern Michigan College pilot distance education courses in the Fall term of 1992 and the Winter and Fall terms of 1993 expressed a high degree of satisfaction with the courses at both the sending and receiving sites (Table 7). The seven distance education courses taught from the math and science, communications, and social science divisions of the College all had high levels of student satisfaction. Eight-two percent of the students surveyed stated that they would recommend a two-way audio and

Table 7

Students Learned as Well in Distance Education Course as in a Traditional Course

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
Strongly Agree	1	58	30.4	30.5	30.5
Agree	2	91	47.6	47.9	78.4
Disagree	3	24	12.6	12.6	91.1
Strongly Disagree	4	8	4.2	4.2	95.3
Not Applicable	5	9	4.7	4.7	100.0
	.	1	.5	Missing Data	
	Total	191	100.0	100.0	

and video interactive courses to others. It is interesting to note that an analysis of the responses using crosstabs reveals that the level of support is much greater for the fall terms as compared to the winter term (Table 8).

Through discussions with staff at Northwestern Michigan College, other perceived benefits have been identified. It is assumed that there will be a benefit derived from being able to offering a course by pooling several sites so that the necessary minimum number of students are available to make the course cost effective. This may mean that a low enrolled course at several locations can make a full course when combined. This principle currently holds true with courses at the Cadillac campus. It is assumed that university level courses may be offered at several sites across the state,

including Traverse City, from one sending site. This should provide cost savings to the University by eliminating travel expenses for faculty members to travel to remote sites.

Table 8

Students Recommendation of Interactive Video Courses to Others by Course Term

	TERM			
Count / Exp Val / Row Pct / Col Pct / Tot Pct	FALL 92 1	WINTER 93 2	FALL 93 4	Row Total
STRONGLY AGREE	27 21.5 40.9% 43.5% 14.2%	7 13.9 10.6% 17.5% 3.7%	32 30.6 48.5% 36.4% 16.8%	66 34.7%
AGREE	27 29.4 30.0% 43.5% 14.2%	15 18.9 16.7% 37.5% 7.9%	48 41.7 53.3% 54.5% 25.3%	90 47.4%
DISAGREE	7 5.5 41.2% 11.3% 3.7%	5 3.6 29.4% 12.5% 2.6%	5 7.9 29.4% 5.7% 2.6%	17 8.9%
STRONGLY DISAGREE	1 4.6 7.1% 1.6% .5%	12 2.9 85.7% 30.0% 6.3%	1 6.5 7.1% 1.1% .5%	14 7.4%
NOT APPLICABLE	0 1.0 .0% .0% .0%	1 .6 33.3% 2.5% .5%	2 1.4 66.7% 2.3% 1.1%	3 1.6%
Column Total	62 32.6%	40 21.1%	88 46.3%	190 100.0%

BEST COPY AVAILABLE

Once the hardware is in place for interactive video and audio, the service can be marketed to organizations within the community to offer professional development opportunities or increased flexibility in conducting meetings through teleconferencing. This may provide an additional revenue source to offset the operating budget of the distance education technology.

In October 1993, school superintendents from the fifteen local public school districts within the Traverse Bay Area Intermediate School district discussed their educational priorities for the next five to ten years at their Fall retreat. Six priorities were developed by the superintendents using matched pair analysis. The highest priority was the support and development of the Northwestern Michigan College distance education network for the Traverse Bay Intermediate Schools which will provide both high school and higher education courses. The next highest priority was staff development in various content areas.

3. What hardware components are currently available at Northwestern Michigan College for implementing distance education?

Using grant funds from the Kellogg Foundation, the college completed construction of two classrooms to utilize compressed video technology for providing two-way video and audio transmission between the Traverse City, Michigan campus and a remote site in Cadillac, Michigan 50 miles away.

Specific equipment utilized in each classroom is listed in Appendix A. Courses were offered for the first time during the fall term of the 1992-1993 school year.

4. What are the implementation costs for distance education at Northwestern Michigan College?

Included in the University Center project being proposed by Northwestern Michigan College is the technology needed to provide interactive classrooms in each of fifteen local high schools and have six interactive classrooms on the college's Traverse City campus. The implementation costs include the construction of the last loop of fiberoptics from the existing cable fiber network to each school building. Once this is installed the fiber highway will be complete. Also included in the implementation costs is the network transmission equipment which moves the signal over the fiber network and the classroom equipment which is needed to produce the audio and video signals to send on the network.

Total implementation costs are estimated at $2,684,687 as of December, 1993. A detailed breakdown of the component costs is included in Appendix B.

5. What funding sources are available to provide the resources necessary to implement the distance education plan for Northwestern Michigan College?

Using Cost feasibility analysis, the total cost of an initiative is compared to the funds available for funding.

This study will examine what funds are available to be expended on the implementation costs of $2,684,687.

Northwestern Michigan College has been appropriated $2.4 million in Appropriation P.A. 19 of 1993, Fiscal year 93, 94, 95 Capital Outlay Act of the State of Michigan. These funds are for the University Center and Business Education Center at Northwestern Michigan College. The total project, including the distance education technology needed to connect to the local high schools and provide additional interactive classrooms on the College campus, is expected to cost $5.9 million. The College needs to raise the additional $3.5 million through grants, private donations and College Building and Site funds.

Northwestern Michigan College has received a grant through Ameritech in conjunction with the State of Michigan for $355,000 for installation of the fiber network needed to connect the College and local high schools. As of December 1993, $439,000 in private donations for interactive classrooms have been received and deposited in the Northwestern Michigan College Foundation.

Northwestern Michigan College has submitted a proposal to the Kellogg Foundation for $1.5 million to establish the interactive network between the College and local high schools. The proposal requests $1.0 million for the interactive distance education technology and $500,000 for instructional technology training for faculty.

A request has been made to the Traverse City Rotary Foundation for $1.0 million to support the distance education needs of Northwestern Michigan College and the local school districts. It is expected that approval of the grant will be received in January, 1994.

Total grant requests and funds received equal $5,394,000 for the University Center and the associated distance education technology. In addition, the Pre-campaign study performed by Monaghan Associates Inc. indicated that a fund raising goal of $3.5 million is feasible within the community Northwestern Michigan College serves.

The implementation of distance education technology as proposed by Northwestern Michigan College in conjunction with a University Center is cost feasible. There are funds available to be expended on the implementation of planned distance education technology.

6. What are the operating costs of distance education at Northwestern Michigan College?

Operating costs consist of transmission costs, maintenance of equipment and personnel to operate the system. Transmission costs as currently known are included in Appendix C. A projection of annual maintenance costs has not yet been completed. It is expected that the expanded distance education network will be run by the current Audio-visual staff of the Director-Media Services, and one and one-half technicians, with the addition of another one-half time technical position. Funding of the additional staff has been

secured through an agreement with C-Tec Cable for operation of the local public access television channel.

7. What planning process should be used to make decisions on implementation and evaluation of distance education at Northwestern Michigan College?

Based on the literature search conducted, the most comprehensive planning process was proposed by Levine. The following are the stages in the distance education planning process (Levine, 1992):

1. Determine whether a demand exists for a distance education program and whether the mission of the institution is well served by the development of such a program.

2. Identify policies-both external and internal-that might affect the success of the program and work to eliminate those that might serve as barriers.

3. Build a broad base of support for the legitimacy and value of distance education.

4. Examine the degree programs currently offered at the institution(s) to see which adapt readily to distance education models.

5. Select from among available courseware those instructional packages that meet local needs.

6. Develop locally produced distance education courses to complete degree requirements.

7. Evaluate the cost effectiveness and availability of telecommunications alternatives for content delivery and student-faculty interaction that meet both course objectives and the needs of distance learners.

8. Ensure that student services meet the needs of distance learners.

9. Select excellent faculty and train them in effective distance education teaching methods

and in the use of telecommunications technologies.

10. Develop an evaluation plan that involves faculty, administrators and students.

This planning process is comprehensive and easily applied to the specific educational organization involved in distance education initiatives.

Summary of Major Findings

1. The percent of high school graduates for the five county area serviced by Northwestern Michigan College was 1.7% greater than the State total for high school graduates, while the percent of bachelor degrees or higher for the five county area was 1.0% lower than the State total. In addition to the lower percentage of residents having four-year degrees, the per capita income was $3,680 lower than the State per capita income.

2. Grand Traverse County residents provided input to planners as they outlined their vision for the community in the year 2000. In the area of education, the vision clearly stated the desire for Northwestern Michigan College to become a university, or for the college to expand the opportunities for advanced degree courses and programs for the region.

3. According to a Michigan Department of Education Project Outreach Survey of students enrolled at Northwestern Michigan College during the winter term of 1991, 46.0% of all enrolled students had university transfer credit as their primary educational goal.

4. The Michigan Department of Education Project Outreach Survey of Grand Traverse area residents in 1991 stated that 81.0% of the respondents said it was important or somewhat important that four-year college classes be expanded in the Traverse City area, 88.0% indicated that a college education was very important, 65.0% of the residents stated that they would take more college courses in Traverse City if there was a greater variety of courses and programs offered, and 57.0% of the respondents wanted the college offerings close to home.

5. A study of former community college students indicated that 21.0% of the former students did not re-enroll at community colleges because they transferred to a four-

year institution. Transfer was listed as the primary educational goal of 31.0% of the former community college students.

6. The 1992 Michigan Department of Education Project Outreach Statewide Survey of enrolled community college students indicated that 43.0% of the students planned to transfer to a four-year school as their primary educational goal.

7. The Traverse Bay Economic Development Corporation in 1992 studied the service sector businesses and identified that the lack of baccalaureate programs was one of the impediments to business growth.

8. Of those in attendance at forums held in the five county area, 99.6% indicated that they believed a University Center is important to the future of northwestern Michigan with 90.7% stating that they would enroll if provided such a center.

9. Of the high school students sampled, the majority, 54.3% indicated plans for full-time attendance at a college with an additional 22.5% planning to work and attend college on a part-time basis.

10. Of the high school students responding, 40% stated that they would attend Northwestern Michigan College for two years and then transfer to a four-year institution, providing classes were at the University Center located on the campus of Northwestern Michigan College.

11. Of Northwestern Michigan College students surveyed, 56% planned to transfer to a four-year university. Sixty-nine percent of the students planning to attend a college or university after completing their studies at Northwestern Michigan College stated that they were planning to earn a masters degree as their ultimate goal.

12. When asked if they preferred to complete the four-year degree in Traverse City, 71% of Northwestern Michigan College students seeking advanced degrees surveyed indicated that they would complete the degree in Traverse City if the program and courses were offered.

13. The educational effectiveness of distance education, specifically interactive televised instruction, is high. Studies focusing specifically on interactive distance education revealed that there are no significant differences in academic performance for students in technologically delivered courses and traditional classroom settings.

14. It is assumed that there will be a benefit derived from being able to offering a course by pooling several sites so that the necessary minimum number of students are available to make the course cost effective.

15. There are sufficient funding sources available to fund implementation of the planned distance education network for Northwestern Michigan College.

16. There exists a practical planning model for the implementation of distance education technology.

17. Students enrolled in the pilot distance education courses at Northwestern Michigan College at both the sending and receiving sites indicated that they would take additional courses via distance education. The students also indicated that they would recommend taking distance education courses to others.

CHAPTER V

Summary and Discussion

Northwestern Michigan College is geographically isolated from four-year institutions of higher education. This has presented challenges for residents who want to continue their education past the second year of college. Northwestern Michigan College serves the five county region of Antrim, Benzie, Grand Traverse, Kalkaska, and Leelanau counties. According to the 1990 U.S. Census (1990), the percentage of high school graduates for this region was 78.5%, or 1.7% greater than the Michigan total of 76.8%. The percentage of bachelor degrees or higher for the five counties was 16.4%, which was 1.0% lower than the State's total of 17.4%. In addition to a lower level of degree completion, the per capita income in 1990 for the five counties was $3,680 lower than the State.

While the need exists for expanded higher education opportunities in the region Northwestern Michigan College serves, the College does not intend to abandon its mission as a community college to become a four-year institution. Northwestern Michigan College faces the same dilemma that other higher education institutions have, to provide educational opportunities to an increasing and diverse population with decreasing resources. In 1992, discussions began on how to best meet the educational needs of the

community. The concept that evolved is referred to as a University Center. This is a relatively new concept that involves partnerships with four-year institutions to offer courses beyond the second year of college.

The focus of campus-wide discussion has turned to the best way to facilitate the delivery of upper division courses. Northwestern Michigan College began to use two-way interactive video and audio instruction to a remote site located 50 miles away in Cadillac, Michigan, in the Fall of 1992 as a pilot project. It is now necessary to determine whether two-way interactive video and audio is an effective method both as measured by cost and educational outcomes for the offering of courses. If so, this technology would be used to deliver advanced courses as coordinated by the University Center.

This study is an evaluation study that uses decision-oriented and cost-oriented approaches (McMillan & Schumacher, 1989). Needs assessments were completed to evaluate the need for expanded advanced degree offerings in the area served by Northwestern Michigan College and the receptiveness to the use of distance education technology to provide those additional educational opportunities.

A cost analysis of distance education was completed using cost-feasibility analysis (Levin, 1981). To assist in developing a funding program for the construction of the University Center, a pre-campaign audit was conducted by a consultant hired by Northwestern Michigan College.

Since the pilot project using two-way interactive video was implemented in the Fall of 1992, an implementation evaluation was done by surveying students at both the sending and receiving sites for Fall and Winter terms in 1993. Historical data for this study was collected from several types of data sources which included: literature searches, independent studies, and surveys.

Major findings of this study are as follows:

1. The percent of high school graduates for the five county area serviced by Northwestern Michigan College was 1.7% greater than the State total for high school graduates, while the percent of bachelor degrees or higher for the five county area was 1.0% lower than the State total. In addition to the lower percentage of residents having four-year degrees, the per capita income was $3,680 lower than the State per capita income.

2. Grand Traverse County residents provided input to planners as they outlined their vision for the community in the year 2000. In the area of education, the vision clearly stated the desire for Northwestern Michigan College to become a university, or for the college to expand the opportunities for advanced degree courses and programs for the region.

3. According to a Michigan Department of Education Project Outreach Survey of students enrolled at Northwestern Michigan College during the winter term of 1991, 46.0% of all enrolled students had university transfer credit as their primary educational goal.

4. The Michigan Department of Education Project Outreach Survey of Grand Traverse area residents in 1991 stated that 81.0% of the respondents said it was important or somewhat important that four-year college classes be expanded in the Traverse City area, 88.0% indicated that a college education was very important, 65.0% of the residents stated that they would take more college courses in Traverse City if there was a greater variety of courses and

programs offered, and 57.0% of the respondents wanted the college offerings close to home.

5. A study of former community college students indicated that 21.0% of the former students did not re-enroll at community colleges because they transferred to a four-year institution. Transfer was listed as the primary educational goal of 31.0% of the former community college students.

6. The 1992 Michigan Department of Education Project Outreach Statewide Survey of enrolled community college students indicated that 43.0% of the students planned to transfer to a four-year school as their primary educational goal.

7. The Traverse Bay Economic Development Corporation in 1992 studied the service sector businesses and identified that the lack of baccalaureate programs was one of the impediments to business growth.

8. Of those in attendance at forums held in the five county area, 99.6% indicated that they believed a University Center is important to the future of northwestern Michigan with 90.7% stating that they would enroll if provided such a center.

9. Of the high school junior and senior students sampled, the majority, 54.3% indicated plans for full-time attendance at a college with an additional 22.5% planning to work and attend college on a part-time basis.

10. Of the high school junior and senior students responding, 40% stated that they would attend Northwestern Michigan College for two years and then transfer to a four-year institution, providing classes were at the University Center located on the campus of Northwestern Michigan College.

11. Of Northwestern Michigan College students surveyed, 56% planned to transfer to a four-year university. Sixty-nine percent of the students planning to attend a college or university after completing their studies at Northwestern Michigan College stated that they were planning to earn a masters degree as their ultimate goal.

12. When asked if they preferred to complete the four-year degree in Traverse City, 71% of Northwestern Michigan College students seeking advanced degrees surveyed indicated that they would complete the

degree in Traverse City if the program and courses were offered.

13. The educational effectiveness of distance education, specifically interactive televised instruction, is high. Studies focusing specifically on interactive distance education revealed that there are no significant differences in academic performance for students in technologically delivered courses and traditional classroom settings.

14. It is assumed that there will be a benefit derived from being able to offering a course by pooling several sites so that the necessary minimum number of students are available to make the course cost effective.

15. There are sufficient funding sources available to fund implementation of the planned distance education network for Northwestern Michigan College.

16. There exists a practical planning model for the implementation of distance education technology.

17. Students enrolled in the pilot distance education courses at Northwestern Michigan College at both the sending and receiving sites indicated that they would take additional courses via distance education. The students also indicated that they would recommend taking distance education courses to others.

Distance education technology is feasible for Northwestern Michigan College because the need for expanded educational opportunities and the availability of funding sources has been established. While feasibility has been validated, long-term success will be dictated by an effective strategic plan. The ten stage planning model provided by Levine (1992) offers a framework to evaluate the long-term feasibility of distance education at Northwestern Michigan College.

Stage 1: The demand for expanded educational opportunities is indicated by the below State average educational and economic achievement of the residents of the five county area serviced by Northwestern Michigan College. Adult residents, high school and community college students have all indicated their desire for course offerings beyond the first two years of college.

Distance education technology is a medium that will facilitate the offering of the advanced coursework. While some courses may be taught by university faculty that travel to northwest Michigan, many courses may be offered by interactive compressed video and audio. Residents attending county forums indicated that they were receptive to the use of interactive technology. Students that have participated in interactive distance education courses have provided strong support for the technology at both the sending and receiving sites.

Interactive classrooms located in local high schools will allow local school districts to share resources and offer low enrolled courses by using teachers to teach a specialized course to students at multiple sites. These classrooms will also allow current courses offered by Northwestern Michigan College to be offered at local high schools for high school students trying to begin their college coursework or high school graduates who would like to take courses closer to home.

The Board of Trustees of Northwestern Michigan College have approved the University Center initiative, including the use of distance education technology. Some concerns have been expressed by College faculty and staff that expenditures for new technology and or facilities may reallocate resources away from existing programs. It is essential that the administration of Northwestern Michigan College be able to tie the use of distance education to the mission of the institution.

Stage 2: Northwestern Michigan College is in the second year of its governance structure that was initiated in response to concerns over the ineffectiveness of previous structures, and to implement more of a Total Quality Management leadership philosophy. The current governance system utilizes councils that make recommendations to the President of the College. There are seven councils: Planning Council, Budget Council, Policy Council, President's Council, and the three employee group councils (Support staff, Administrative and Professional staff, and Faculty).

The College administration needs to work with the appropriate councils to identify policies, both internal and external, that may affect the success of the implementation of distance education programs. For example, there will need to be discussions regarding possible incentives for faculty who teach interactive distance education courses. It will be essential that the issues be addressed within the current

governance structure and that barriers to success be minimized.

Stage 3: A broad base of support for the use of distance education needs to be built within the staff of the College and within the communities it serves. There needs to be an effort to inform faculty and staff of the research that has validated the educational effectiveness of interactive distance education technology. Faculty and student responses to courses already taught at Northwestern Michigan College need to be disseminated. As partnerships are developed with the four-year institutions, their support of distance education technology will need to be strong. The university partners will need to assist in the building of support for the use of distance education technology by Northwestern Michigan College.

The College is also building partnerships with local non-profit agencies that support the use of interactive video and audio. Munson Medical Center in Traverse City has received a $900,000 grant to do the following:

1. Establish the Rural Emergency Medical Education Consortium (REMEC), comprised of Munson Medical Center, Northwestern Michigan College, Grand Traverse Area Medical Control Authority and North Flight EMS.

2. Implement an interactive video Teleconference network serving rural medical facilities.

3. Develop a comprehensive educational curriculum to meet the unique requirements of rural emergency medical technicians, nurses, and physicians.

It will be important to the College to continue to build partnerships with local governmental agencies, non-profit organizations, business and industry to meet all the educational needs of the community.

Stage 4: The Media Services division of Northwestern Michigan College is continually examining current courses for their adaptability to distance education technology. With the use of two-way interactive video and audio, there are very few courses that would not easily adapt to this technology.

Stage 5: Northwestern Michigan College has determined that the most effective distance education technology is two-way interactive video and audio transmitted using compressed video. The College does offer some traditional telecourses that are pre-recorded videos. The video programming is also aired over the regional cable network channel.

Stage 6: Northwestern Michigan College has developed a locally produced video tape series for Dental Radiology as one form of distance education. Interactive video courses have been presented by Northwestern Michigan College instructors in: Technical Writing, Introduction to Psychology, Russian History, History of Vietnam, Introduction to Criminal Justice, Introduction to Marketing, Early Childhood Development, and Trigonometry. New courses will be developed as demand dictates.

Stage 7: Levine's (1992) model suggests that cost-effectiveness be evaluated. From the search of literature on

cost effectiveness models many different approaches to measuring cost effectiveness were found to exist. The literature also indicates that the effectiveness of interactive video as an instructional method has been proven in many studies. If it is assumed that the effectiveness of two-way interactive video and audio technology is the same as traditional classroom instructional methods, then only the cost of distance education needs to be analyzed in any cost-effectiveness study. Defining cost is not a simple process. A methodology needs to be agreed upon by the staff of Northwestern Michigan College.

Some costing models factor in the opportunity cost of capital while others allocate back the costs of support services. The model used should be applicable to costing all instructional programs, not just those offered via distance education technology. The same assumptions should be used regardless of the medium used to teach the course. Many issues will need to be resolved. Some examples are:

1. Should local property taxes be allocated to each course taught and by what method?
2. Should State appropriations be allocated to each course taught and by what method?
3. What administrative and support costs should be allocated to each course taught and by what method?
4. Should the opportunity cost of capital be a factor in any cost analysis?
5. What is an acceptable income or loss level for a course to operate at?

In stage seven, Levine (1992) recommends evaluating the availability of telecommunications alternatives for content delivery and interaction. Northwestern Michigan College has made the commitment to interactive video and audio using compressed video technology.

Stage 8: Northwestern Michigan College should determine the level of student services needed to be provided to meet the needs of their distance learners. As proposals from potential University Center partners are reviewed, the level of student services proposed needs to be evaluated.

Stage 9: Student evaluations of courses that have been offered by Northwestern Michigan College using two-way interactive video technology indicate that faculty have used effective distance education teaching methods. The College needs to formalize a procedure for assuring that as new faculty begin to utilize interactive video technology they are adequately trained and are effective in the use of distance education teaching methods.

Stage 10: Northwestern Michigan College should develop an evaluation plan that involves faculty, administrators and students. Such a plan should measure effectiveness using consistent criteria such as are suggested by Richard Johnson (1986):

1. Student learning of information and understanding. This is usually measured by academic assessments.

2. Student satisfaction with content and process of the course. This is usually measured by a student questionnaire.

3. Retention rates and graduation rates.

4. Employability or advancement within employment.

Johnson (1986) also suggests that there are eight distance education activities whose outcomes need to be judged against the four criteria to evaluate effectiveness:

1. Academic production: The decisions on course content and topics, educational approach, examples, exercise and practical work, which ultimately depend on the educational goals of the course and the philosophy of the teachers.

2. Materials production: The production of the written materials, illustrations, audiovisual materials, kits and so on.

3. Distribution: By mail or broadcast or facsimile or computer or whatever; to individual students or to regicnal centers used by groups of students.

4. Interaction: Of student with teacher or with other students; by mail, telephone, computer etc; individually or in groups; at a distance (through teleconference) or face-to-face.

5. Exercise: Readings, library materials, practical work, work experience, assignments.

6. Assessment: To diagnose student learning, to gauge student progress, to measure student attainment.

7. Evaluation: Of course content, course materials, methods of presentation, delivery, student support systems; the possible need for changes to any of these.

8. Student support/guidance: Before enrollment or during course; educational and psychological support; by academic and general staff and by other students or other people.

The conclusions drawn in this study are based on survey results from surveys conducted by researchers not affiliated with this study. This study is limited to literature that was available as of the date of the study. New research information on distance education continues to be added to the base of knowledge in educational research.

Other educational institutions considering initiatives in distance education should consider using the planning model used in this study to determine the distance education technology that is most appropriate for meeting their instructional needs. The historical literature search should be utilized to provide the faculty and administration an overview of the current knowledge of distance education. As concerns or questions arise during the planning process further research into the literature can be done by reading the original sources cited in this study.

The literature search yielded many cost analysis models, but no clear consensus exists as to the most valuable and accurate model. Cost analysis models vary from the very simplistic to complex; from the economist's view to the accountant's view. This researcher believes that any model used which includes the opportunity cost of capital should be closely scrutinized.

In reality, most capital costs for distance education are funded by grant funds or designated gifts from donors. These funds would not have been available for other purposes and

therefore cannot be considered as a loss to other programs. In education, this is true of many initiatives, funds are available for projects that funding sources believe to be of value. These resources cannot be reallocated for other purposes.

For higher education institutions to meet the ever-changing needs of their students with shrinking resources new partnerships will need to be established. It will be important to join with other non-profit organizations, business and industry to combine resources. This is especially true for community colleges. Because community colleges are funded in part, by local property taxes, they are responsible for assuring local taxpayers that tax dollars are being used efficiently. Taxpayers want to see that all governmental units that receive tax support are using the resources efficiently. It will be important that the governmental units form partnerships for common initiatives rather than duplicating services. Community colleges should be leaders in providing professional development and other teleconferencing opportunities for all governmental units. By pooling the resources of all the tax supported units this will be achieved with greater efficiency.

Other non-profit organizations, business and industry have similar professional development and teleconferencing needs. These organizations are possible additional funding sources for distance education, especially two-way video and

audio technology. Community colleges have historically been quick to respond to the training needs of local business and industry. Community colleges need to forge new partnerships with other non-profit organizations, business and industry to utilize distance education technology to meet the training needs of these organizations and gain financial support.

Additional research should be done into the cost analysis of distance education as applied specifically to two-way interactive video and audio using compressed video technology. Another area in need of expanded research is to determine how prevalent the use of compressed video technology is in higher education, in particular it would be of interest to compare Northwestern Michigan College's initiative to that of other Michigan community colleges.

Northwestern Michigan College's use of compressed video technology to provide interactive two-way video and audio instruction should continue to be monitored as to cost effectiveness. As the recommendations of this study regarding the use of a planning model are implemented, it will also be important to document the results. In conclusion, Northwestern Michigan College will continue to implement interactive distance education technology, but the success of the initiative will be directly tied to whether the recommendations of this study are implemented.

APPENDIX A

Specific Equipment Required for Classrooms
Sending & Receiving Two-way Interactive Audio & Video

1 of 2

Quantity	Model/Manufacturer	Cost
3	Panasonic Camera Body WV-D5100	$ 3,900
3	Panasonic 8X Autofocus Lens WV-LZ148AF	1,500
3	Panasonic 10 pin Power Cable WV-CA10	120
3	Panasonic Camera Power Supplies WV-3203	300
2	Panasonic 10 pin 30 feet Cables 10H-30AS	200
2	Panasonic 10 pin 50 feet Cables 10H-50AS	300
1	Panasonic Active Switcher AG-SW100	900
4	JVC 27" Monitors/Receivers AV-2761S	2,808
4	JVC 31" Monitors/Receivers AV-31BM4	3,300
1	Panasonic Camera Mount WV-831	55
2	Peerless Camera Mounts CMR 443	150
2	Pelco Pan & Tilt Camera Mounts PT 270	910
2	Pelco Pan & Tilt Remote Control MPT 115DT	314
4	Peerless Jumbo Ceiling Mounts CMJ 660 ST	760
4	Peerless Structural Ceiling Plate CMJ 460	120
4	Peerless Extension Columns Ext 103	40
4	Peerless Escutcheon Rings ACC 640	15
1	Custom Made Quad 31" Monitor Cabinet	2,700
2	Winstead Shelves #87071	94
1	Winstead 20" Pull Out Shelf #85083	179
1	JVC 9" Color Monitor TM-9U	461
1	Panasonic Distribution Amplifer AG DA100	750
1	Coherent Voicecrafter Echo Cancellor	6,500
4	Crown PCC 160 Microphones	1,120

APPENDIX A

Specific Equipment Required for Classrooms
Sending & Receiving Two-way Interactive Audio & Video

2 of 2

Quantity	Model/Manufacturer	Cost
2	University Sound Speakers MARK S100B	210
2	Speaker Mounts	50
2	BiAMP Audio Mixer	900
3	QSI 1500 Demodulator/Tuner	4,500
1	Coherent Voicecrafter Audio Control Console	280
1	Custom Made Teacher Station/Console	1,500
1	Sony VHS Player/Recorder SVO 1410	350
1	Custom Made Control Panel/Console/Keypad	300
1	Instructor Stool	460
1	Savin Fax/Copier #3620	2,000
1	Other Materials, Wire, Connectors	2,000
	Estimated Installation Costs	2,500
	Total Classroom Costs	$ 42,546

APPENDIX B

Breakdown of Two-way Interactive Audio & Video Costs

1 of 2

FIBER CONSTRUCTION - "LAST MILE LOOP" COSTS

Region	School District	Miles from headend	Cost
Eastern	Elk Rapids	1	$ 10,560
	Alba	10	105,600
	Bellaire	2	21,120
	Kalkaska	2	21,120
	Mancelona	5	52,800
Western	Benzie	5	52,800
	Frankfort	12	126,720
	Glen Lake	8	84,480
	Leland	3	31,880
	Suttons Bay	1	10,560
	Northport	15	158,400
Southern	Kingsley	6	63,360
	Forest Area	17	179,520
Central	Northwestern	Online	Complete
	TBA ISD	Online	Complete
	Traverse City	Online	Complete
Total Cost -	Last Mile Loops -	Subtotal	$ 918,920

CLASSROOM EQUIPMENT COSTS

Interactive Classrooms (11 @42,546)	$ 468,006
Interactive Classrooms at College	127,638
Interactive Classrooms at University Center	132,138
Total Cost - Classroom Interactive Equipment	$ 727,782

APPENDIX B

Breakdown of Two-way Interactive Audio & Video Costs

2 of 2

TRANSMISSION VIDEO EQUIPMENT COSTS

For Cable Headend:	
Fiber Optic Transmitter (AM)	$ 59,500
Fiber Optic Amplifier	20,500
Receivers (21 @ $3,500)	73,500
Modulators (21 @ $2,000)	42,000
For Schools Transmit & Receive:	
Fiber Optic Transmitter (FM) (21 @ $5,000)	$105,000
Fiber Optic Receive (AM) (21 @ $2,000)	42,000
Northwestern Michigan College Hub:	
Routing Switcher	$ 60,000
Compressed Video Equipment	145,165
Compressed Video Bridge Equipment	87,745
Master Control Upgrade	18,200
Distribution of T-1 Circuits	10,000
Distribution of IAC Signals	14,375
Data Transmission Equipment:	
Data Send & Receive for 13 Sites	$260,000
Data Send & Receive for NMC and TBA	100,000
Total Cost- Transmission Equipment - Subtotal	1,037,985

SUMMARY OF COSTS

Fiber Construction - "Last Mile Loops"	$ 918,920
Classroom Equipment Costs	727,782
Transmission Equipment Costs	1,037,985
Total Project Interconnect Completion Costs	$2,684,687

APPENDIX C

Transmission Costs for Two-way Interactive Audio & Video

A. Credit Coursework (University Center Partners) $ 22.00/Hour*

T-1 Line Charge	$ 1,192.00
Assend Box Maintenance	35.00
Technical/Electronic Repairs (5%)	45.00
Mechanical Repairs (1%)	10.00
Total (60 hours per month)	$ 1,282.00

B. Non-Credit Coursework (Non-Profit Organizations) $ 37.00/Hour*
Full Costs Without Technician

T-1 Annual Line Charge	$14,304.00
Classroom Rental (7 years)	10,860.00
Assend Box Maintenance	420.00
Technical/Electronic Repairs	543.00
Mechanical Repairs	109.00
Total (12 months)	$26,236.00
Total (60 hours per month)	$ 2,190.00

C. Proprietary Rate $102.00/Hour*
Full Costs with Technician and Overhead

T-1 Annual Line Charge	$14,304.00
Classroom Rental (7 years)	10,860.00
Assend Box Maintenance	420.00
Technical/Electronic Repairs	543.00
Mechanical Repairs	109.00
Technician	37,500.00
Overhead (15%)	9,366.00
Total (12 months)	$73,102.00
Total (60 hours per month)	$ 6,092.00

* Additional charge of $30.00 per hour if phone calls made from NMC site.

BIBLIOGRAPHY

Acerri, F. U. (1989). Distance education. Unpublished manuscript, Wayne County Intermediate School District, MI.

Ansari, M. M., (1992). Economics of Distance Higher Education. New Delhi: Concept Publishing Company.

Banach, W. J. (1992). The Founders 21 University Center Survey. Unpublished manuscript.

Beaudoin, M. (1990). The instructor's changing role in distance education. The American Journal of Distance Education, 4(2), 21-29.

Bradshaw, D., & Brown, P. (1989). The promise of distance learning. Policy briefs number eight. (Report No. IR 014 463). Far West Laboratory for Educational Research and Development, San Francisco, CA. (ERIC Document Reproduction Service No. ED 323 909).

Brey, R. (1991). U.S. postsecondary distance learning programs in the 1990s a decade of growth. (Report No. JC 920 023). Washington, DC: The Instructional Telecommunications Consortium, American Association of Community and Junior Colleges. (ERIC Document Reproduction Service No. ED 340 418).

Congress of the United States, Office of Technology Assessment. (1989). Linking for learning, a new course for education. (OTA-SET-430). Washington, DC: U.S. Government Printing Office.

Congress of the United States, Office of Technology Assessment. (1989). Effects of distance learning: A summary of the literature. Washington, DC: U.S. Government Printing Office.

Dillon, C. (1989). Faculty rewards and instructional telecommunications: a view from the telecourse faculty. The American Journal of Distance Education, 3(2), 35-43.

Duning, B. S., VanKekerix, M. J. & Zaborowski, L. M. (1993). Reaching learners through tele-communications. San Francisco, CA: Jossey-Bass Publishers.

Ettorre, B. (1993). Benchmarking: the next generation. Management Review. 82(6), 10-16.

Garrison, D. R. (1990). An analysis and evaluation of audio teleconferencing to facilitate education at a distance. The American Journal of Distance Education, 4(3), 13-23.

Garrison, D. R., & Shale, D. (1987). Mapping the boundaries of distance education: problems in defining the field. The American Journal of Distance Education, 1(1), 7-13.

Garrison, D. R., & Shale, D. (1990). Education at a distance: from issues to practice. Malabar, Fl: Robert E. Krieger Publishing Company.

Gehlauf, D. N., Shatz, M. A, & Frye, T. W. (1991). Faculty perceptions of interactive television strategies: implications for training. The American Journal of Distance Education, 5(3), 20-28.

Grand Traverse 20/20 Steering Committee. (1991). Summary report, results of information obtained at Grand Traverse 20/20 futuring sessions and summary conference, May, 1991. Unpublished manuscript. Traverse City, MI: Author.

Gunawardena, C. N. (1990). Integrating tele-communications systems to reach distance learners. The American Journal of Distance Education, 4(1), 38-46.

Harroun, H. L. (1991). Using technology to improve equity of curriculum access for students in Michigan's upper peninsula. Unpublished doctoral dissertation, Western Michigan University, Kalamazoo, MI.

Hershfield, A. F. (1986). Distance education: the promise and the confusion!. (Report No. EA 019 167). Paper presented at the annual international conference on improving university teaching (12th, Heidelberg, F. R. Germany, July 15-18, 1986). (ERIC Document Reproduction Service No. ED 019 167).

Holmberg, B. (1989). Theory and practice of distance education. New York: Routledge.

Johnson, R. (1986). Effectiveness and efficiency in distance education. (Report No. IR 012 671). Paper presented at the Conference on Productivity in Tertiary Education, Toowoomba, Queensland, Australia, July 3-6, 1986. (ERIC Document Reproduction Service No. ED 282 527).

Kabat, E. J., & Friedel, J. (1990). The development, pilot testing, and dissemination of a comprehensive evaluation model for assessing the effectiveness of a two-way interactive distance learning system. (Report IR 015 038). Eastern Iowa Community College District, Davenport, IA. (ERIC Document Reproduction Service No. ED 332 690).

Kaye, A. & Rumble, G. (1981). Distance Teaching for Higher and Adult Education. London: Croom Helm.

Keegan, D. (1986). The Foundations of Distance Education. London: Croom Helm.

Kish, L. (1967). Survey Sampling. New York: Whiley.

Lape, D. (1991). Using distance learning to increase course access for students in Michigan's community colleges. Unpublished manuscript, Western Michigan University, Kalamazoo, MI.

Lape, D. (1992). University center analysis of county forums for Northwestern Michigan College. Unpublished manuscript, Western Michigan University, Kalamazoo, MI.

Lape, D. (1993). University center analysis of high school students in Antrim, Benzie, Grand Traverse, Kalkaska, & Leelanau Counties. Unpublished manuscript, Western Michigan University, Kalamazoo, MI.

Levine, T. (1992). Going the distance, A handbook for developing distance degree programs using television courses and telecommunications technologies. Bethesda, MD.

Lorenzo, A. L. (1993). Envisioning new horizons: Report of the commission on new directions for Michigan community colleges. Unpublished manuscript, Michigan Community College Association, Lansing, MI.

Mace, J. (1982, June). Educational media and economic analysis. Media in Education and Development. pp. 91-93.

Markwood, R. A., & Johnstone, S. M. (Eds.).(1992). New pathways to a degree. Western Cooperative for Educational Telecommunications, Boulder, CO.

McMillan, J. H., & Schumacher, S. (1989). Research in education: A conceptual introduction (2nd ed). Glenview, IL: Scott Foresman.

Michigan Department of Education. (1992 a). 3rd Community College Poll: A Student Perspective. Conducted April 21-May 5, 1992. Lansing, MI.

Michigan Department of Education. (1992 b). 2nd Community College Poll: A Former Student Perspective. Conducted May 11-May 28, 1992. Lansing, MI.

Moore, G. W. (1983). Developing and evaluating educational research. Boston: Little, Brown.

Moore, M. G., & Clark, G. C. (1989). Readings in distance learning and instruction. American Center for the study of Distance Education, Pennsylvania State University, University Park, PA.

Norusis, M. J.·(1990). SPSS: Statistical data analysis. Chicago, IL: SPSS.

O'Hara, L., & Patton, S. (1992). A rural communiversity: teaching through developmental through graduate courses via two-way video. Unpublished manuscript, Paducah Community College, Paducah, KY.

Perraton, H. (1982). The Cost of Distance Education. IEC Broadsheets on Distance Learning No. 17, Cambridge, England: Russell Press Ltd.

Perraton, H. (1983). Secondary education at a distance. International Extension College, Cambridge, England: Russell Press Ltd.

Rumble, G. (1988). The economics of mass distance education. Prospects. XVIII(1), 91-102.

Rumble, G. (1986 a). Activity costing in mixed-mode institutions: A report based on a study of Deakin University. Deakin Open Education Monograph No. 2, Victoria, Australia.

Rumble, G. (1986 b). Costing distance education. Education Division, Human Resource Development Group, Commonwealth Secretariat. London: Marlborough House Pall Mall.

Rumble, G. (1989). On defining distance education. The American Journal of Distance Education, 3(2), 8-21.

Russell, T. L., (1992). Television's indelible impact on distance education: what we should have learned from comparative research. Research in Distance Education. October, 3-4.

Saba, F., & Twitchell, D., (1988). Research in distance education: The American Journal of Distance Education. 2,(1), 9-24.

Self, C. C. (1983). An overview of educational technologies and implications for staff development at the community college level. (Report No. JC 830 308). Amherst, MA: University of Massachusetts. (ERIC Document Reproduction Service No. ED 231 460).

Shafer, B. S., & Coate, L. E., (1992). Benchmarking in higher education. Business Officer, 26,(5), 28-35.

Sherow, S. & Wedemeyer, C. A. (1990). Origins of distance education in the United States. In Garrison, D. R., & Shale, D. Education at a distance: from issues to practice. Malabar, Fl: Robert E. Krieger Publishing Company.

Simpson, H., Pugh, L. & Parchman, S. W. (1991). An experimental two-way video teletraining system: design, development and evaluation. The American Journal of Distance Education, 12(2), 209-231.

Smith, N. L. (1981). New techniques for evaluation: New perspectives in evaluation, Volume 2. Beverly Hills, CA: Sage Publications.

Strain, J. (1987). The role of faculty member in distance education. The American Journal of Distance Education, 1(2), 61-65.

The Grand Traverse Bay Economic Development Corporation Phase IV report: The planning and implementation of an applied technology center program for the Grand Traverse bay area. (1990). Traverse City, MI: Battelle.

Verduin, J. R., & Clark, T. A., (1991). Distance Education: The Foundations of Effective Practice. San Francisco: Jossey-Bass Publishers.

Warner, R., Vance, B., Kucera, R., & Rollin, S. (1992) Northwestern Michigan College Office of Admissions Annual Report 1991. Unpublished manuscript, Northwestern Michigan College, Traverse City, MI.

Wiersma, W. (1991). Research methods in education. Needham Heights, MA: Allyn and Bacon.

Winston, G. C., (1993). The capital cost conundrum. NACUBO Business Officer. 26(12), 22-27.

Withrow, F. (1990). Star schools distance learning: the promise. Technological Horizons in Education Journal. 62-64.

Woudstra, A. & Powell, R., (1989). Value chain analysis: A framework for management of distance education. The American Journal of Distance Education, 3(3), 7-82.